III. *On the Madreporaria collected by Mr. C. W. Andrews at Christmas Island.* By H. M. Bernard.

There are in all 42 specimens including fragments, representative of the following groups or genera :—

Caryophyllinæ.
Dendrophyllia.
Madrepora.
Montipora.
Porites.
Goniopora.
Pocillopora.
Goniastræa.
Caulastræa.
Galaxea.
Mussa.
Leptoria.
Cœloria.
Prionastræa.
Agaricia.

Of these, one Madrepore, two Montipores, and one *Goniastræa* are described as new species, while it is suggested that the specimen provisionally named *Caulastræa* may belong to a new genus.

The specimens are often very fragmentary, and those in spirit are obscured by soft parts, making their determination difficult. In most cases, however, the genera have been easily recognized, but the specific identifications are entirely provisional. It is practically impossible to work out small collections of Corals in the present unsatisfactory state of Madreporarian systematics. The approximate determinations of the fragments will, however, be sufficient guide as to the general characters of the representatives of the several genera.

The biological notes were added by Mr. Andrews.

Caryophyllinæ M.-E. & H.

There are three small solitary corals growing side by side, the largest of which is 5·5 mm. high, evenly cylindrical, and 3·5 mm. in diameter; the smallest, also cylindrical, is 2·25 mm. in diameter but with the base embedded so that the height is not ascertainable. The specimens are in spirit, with the soft parts completely obscuring the columella and pali, on which the generic and specific characters of this family are founded. There are three cycles of septa in both small and large specimens, of which the primaries are slightly exsert, and apparently laterally granulate or echinulate. The living flesh extends to a variable distance down the outer walls.

Genus Dendrophyllia de Blainville.

Dendrophyllia ehrenbergiana.

Cœnopsammia ehrenbergiana Klunzinger, Cor. iii. p. 56, pl. viii. 9.

There are two specimens, which come nearer to this type in the method of growth than to any other recorded species. The difference between *Dendrophyllia* and *Cœnopsammia* is merely the meeting of the septa in the former, which appears to me very unimportant. Hence I have not hesitated to place these two

specimens, in which the septa appear to run distinct to the columella, under the older generic name.

The specimens are both low groups of calicles rapidly budding, and in one case dying away beneath the living cluster, but in the other rising on a pedestal 2–3 cm. high, and on one side bare of polyps.

Occurs in rock-pools under the cliff on the south side of Flying Fish Cove.

Genus Madrepora.

Madrepora (Isopora) brooki, sp. n.

Corallum with typical growth, viz., a thick common base from which 3 or 4 stout flattened branches radiate outwards, with an upward curve. The tip of each branch expanding and branching again. [The branches are 3–4 cm. thick and 4–6 wide, but as the coral is continually thickening these measurements are of no classificatory importance.]

Certain of the calicles on the tops of the branches or of knobs are thin and cylindrical, and may be as much as 4–5 mm. long by 2·5 in diameter, and among these are others of all lengths but with one side cut down; the larger are nearly complete, the shorter are purely scoop-shaped. Here and there these incomplete calicles appear grouped irregularly round a complete calicle. The whole of the rest of the stock, except on the undersides of the branches (which are warty and nearly bare of calicles), is thickly covered with scoop-shaped calicles of all sizes and turned all ways, the majority looking upward; many are mere punctures on the surface with a slightly raised margin, others have one edge protuberant like a lip; from this all stages are found up to the long scoop-shaped calicle. The calicles show no special feature, their costal ridges are regular, smooth, and not prominent; the whole wall in the larger calicles rapidly solidifies. The interstitial cœnenchyma fills up as systems of floors supported on long spines like that typical of *Astræopora*. The smaller calicles are lighter and more openly reticular.

There is one large complete specimen, two fragments from other stocks, and a branch worn smooth, yet recognizable by the section which shows the peculiar interstitial cœnenchyma. The species differs not only in growth-form, but in size and characters of the larger tubular calicles, from all the members of the subgenus described by Mr. G. Brook in the British Museum Catalogue of Madreporaria, vol. i.

The large specimen was brought up from 11 fathoms by the sounding-lead in Flying Fish Cove. Much of the shore cement seems to be made up of rolled fragments of this madrepore.

Madrepora (?) clathrata Brook.

Madrepora clathrata Brook, Brit. Mus. Madr. i. p. 49, pls. v. & vi.

There are several fragments, one a long branching stalk (13 cm.

long), from what I take to have been a prostrate, or other one-sided growth-form. The branchlets are all turned up one side and grow out at right angles, and the scoop-shaped radial calicles project on the same side also at right angles and are chiefly obsolete on the opposite side. The branches show no trace of fusing together. In other respects, however, it comes nearest to *Madrepora clathrata*. The calicles, both radial and axial, seem to agree in shape and size, and the characters of the cœnenchyma seem to be the same as those described for this species.

The specimens of this and the next species were broken from dense clumps growing on the reef-flat in water about one foot deep at low tide, when the tops of the clumps are exposed for some time.

MADREPORA VALIDA.

Madrepora valida Dana, Zoophytes, p. 461, pl. 35. fig. 1.

There is a complete specimen consisting of a crowd of processes all reaching to about the same height (4 cm.), and rising from a common incrusting base, which seems to come near Dana's type. The tips of most of the processes in the single specimen had been injured, and the coral had attempted to heal the injuries. The axial calicles and a few of the nearer radial calicles are swollen into cœnenchymal knobs, without or with greatly reduced or distorted calicle apertures. Where not injured, the calicles have much the aspect described and figured by Dana, and the section of the processes shows the density of the coral, also mentioned by Dana.

MADREPORA (?) ASPERA Dana.

Madrepora aspera Dana, Zoophytes, p. 468, pl. 38. fig. 1.

A specimen 8 cm. high, in which the tapering branches more or less suddenly proliferate into a number of stunted outgrowths. The septa in the radial calicles show it to belong to the subgenus *Eumadrepora* Brook. The size of its axial corallite, the variously prominent and labellate radial calicles interspersed with minute obsolete calicles, seem to ally it with *M. aspera*. It differs chiefly in the greater crowding of the radial calicles, which were comparatively sparse in the type specimen.

This species forms dense clumps growing on the reef-flat, and partly exposed at low-water.

MADREPORA DELICATULA Brook.

Madrepora delicatula Brook, Ann. & Mag. Nat. Hist. viii. 1891, p. 461.

There are two small detached clusters of twigs which agree with the branchlets of Brook's type of *M. delicatula*. The measurements and shapes of the calicles both axial and radial agree, as also do the markings on the surface as described.

There is no evidence that the growth-form resembled that of

Brook's type. Hence the identification is provisional. Some variation in this respect exists between the specimens which Brook classed under this heading (see Brit. Mus. Madr. vol. i. pl. xxviii. figs. D & E).

Found in pools and channels near the edge of the reef-flat, Flying Fish Cove.

Genus Montipora Quoy & Gaimard.

Montipora spongilla, sp. n.

Description. The corallum forms an erect spike about 5 cm. long and from 1–1·5 thick, which flattens near the top and divides into 2 to 3 or more similar spikes running up, side by side, or diverging at very small angles. The calicles are minute, 0·5 mm., but deep and conspicuous, about 1 mm. apart. The margin, usually formed by a single skeletal thread, is round or slightly petaloid. The septa not very well developed, except the directives, one of which is usually specially conspicuous as a broad plate which may or may not be slightly exsert.

The smooth surface-cœnenchyma is a light friable reticulum, very rough to the touch; the tips of the branches are open flake-reticulum and friable; the coral is very light.

This Montipore is peculiar, not only in its method of growth, but also in its lightness and friability. There is one complete stock.

Occurs in pools on the reef-flat, Flying Fish Cove.

Montipora parasitica, sp. n.

Description. Corallum as a closely incrusting plate on other corals, 5 mm. thick, no free edges, but with a narrow smooth zone running round the margin of the stock, 2–3 mm. broad; within this zone the whole surface is covered by tubercles. These are strikingly variable and are in all sizes, from minute branching or frosted granules to rounded or cylindrical tubercles, coarsely woolly, nearly 1 mm. high, here and there fusing into short ridges, and scattered about in small patches.

The calicles are very irregularly distributed, and vary in size from ·5–·75 mm.; often obscured by the rough uneven tubercular surface. The section is dense, built up of stout trabeculæ, and wherever the surface tubercles are rubbed off, the solid stony texture beneath is seen.

The single specimen is nearly complete and incrusts the base of the type specimen of *Madrepora brooki*. Among known Tuberculate Montipores this seems to stand alone in manner of growth, and in the very variable distribution and development of the tubercles. I believe many more small incrusting tuberculate forms of *Montipora* will be discovered (*cf. M. inconspicua*). They can be easily overlooked, and only attract attention when studied under a pocket-lens.

11 fathoms. Flying Fish Cove.

Genus Porites Lamarck.

There is one small, thin, triangular chip from a stock of *Porites*. The method of growth is unknown. The lower sectional surface shows a regular, rather dense reticulum in which the radiate skeletons of the calicles can still be faintly traced. The calicles are small (1 mm.), polygonal, shallow, but sharply sunk. The walls are either thin, straight, or zig-zag threads, septa appearing irregularly along the margin, or else below it as distinct plates. The pali are stout frosted rods.

This fragment is too small to classify. It comes nearest in the character of its calicles to a group of *Porites* in the National Collection from Ramesvaram, Gulf of Manaar, which I have already described in the MS. of vol. iv. of the 'Catalogue of Madreporaria' as *Porites indica*. Until more is known of its growth and variations it may therefore be provisionally placed with that group.

On the reef-flat, Flying Fish Cove.

Genus (?) Goniopora Quoy & Gaimard.

In the same bottle with the spirit-specimen, provisionally identified with *Goniastræa retiformis* (see below), is a small crumpled incrusting coral with edges slightly free, which has all the appearance of a Goniopore. The specimen is complete and almost too small to allow (without spoiling) of the detachment of portions for close examination of the skeleton, which is now hidden under the retracted soft parts. The budding round the edge is quite different from that of *Goniastræa*, and the top edges of the walls which show in rough outline through the skin are not at all like those of that genus, whereas in both these respects the specimen shows more resemblance to *Goniopora* than to any other stony coral with which I am acquainted.

Explanate Goniopores are by no means common, so that even without closer identification the specimen is of interest.

In pools and channels on the reef-flat, Flying Fish Cove.

Genus Pocillopora Lamarck.

There are three specimens which seem to belong to two species; both form low tufts—in one case of crisp irregular branches, and in the other of thick flattened lobes. The species in this genus are mainly founded on differences of growth-form, and longer series would probably unite many of them. In the present case there appears also to be some difference in the calicles which justify their separation.

Pocillopora (?) brevicornis Dana.

Pocillopora (?) *brevicornis* Dana, Zoophytes, p. 526, pl. 49. fig. 8.

A small tuft, the branchlets below are rounded off, above are angular; the round calicles have a distinct ring of septal striæ.

Pocillopora (?) favosa.

Pocillopora (?) *favosa* Ehrenberg, Corallenthiere, p. 127.

Two small tufts of short, stout, compressed lobes, thickly covered with small conical, or rather pointed processes; no septa visible except as striæ in the very young calicles. These two specimens are placed under this specific heading with some hesitation. In M.-Edwards's description of *P. favosa* a distinct columella is mentioned, but no septa. Mr. Stanley Gardiner [1] describes septa—"the primaries being specially thick and bluntly spined;" and Dr. Klunzinger [2], who photographed the original type, says that there is little columella, and the septa are hardly at all developed. In these last points the two specimens from Christmas Island agree with Ehrenberg's type, but hardly with its more freely branching growth.

Occurs in pools and channels on the reef-flat, Flying Fish Cove.

Genus Goniastræa M.-E. & H.

Goniastræa retiformis.

Goniastræa retiformis (Lamarck) M.-E. & H. Les Coralliaires, ii. p. 446.

Two fragments of a convex small-calicled species of *Goniastræa* which may be provisionally placed with this species. The size of the calicles (3 mm.) agrees, but their depth is greater, at least on the summit of the stock, where it may reach 5 mm.; elsewhere it is 3 mm., as given by Milne-Edwards & Haime.

No locality is given for Lamarck's type.

There is further a spirit-specimen in a good state of preservation, which shows the living colony to have been of a bright green colour. The dried skeletons with attached organic matter are reddish brown.

Found in pools and channels on the reef-flat, Flying Fish Cove.

Goniastræa auricularis, sp. n.

Description. Colony forms ear-shaped, semicircular plates which project horizontally from the sides of rocks. Its upper surface is slightly concave, the edge thin and sharp, supported by continuous epitheca which covers the whole under surface. The thicker parts are about 1·5 cm.

The calicles, owing to the method of multiplication, vary greatly in size, the maximum being about 3·5 mm. The top of the thin wall is a fine zigzag; some 16–18 visible septa rise to the top of the wall and may even make the edge slightly denticulate; between these, faint traces of another cycle can be seen with a pocket-lens. The swollen inner edges of the primaries (at times of a few secondaries also) rise as thick, flattened, round-topped pali to within about 1 mm. of the top of the wall.

[1] Proc. Zool. Soc. 1897, p. 941.
[2] Corallenthiere, iii. 1879, p. 68, pl. vii. fig. 2.

In its explanate growth this is not unlike *G. planulata* of Milne-Edwards & Haime, from some unknown locality, but the calicles in that species are 7–8 mm. across, sometimes lengthening to 15 mm. before dividing, This is the second explanate species of *Goniastræa* which has been recorded, although it may be remarked by the way that the diagnosis of the genus is not so clear as might be, and it is not always easy to distinguish between *Goniastræa* and *Prionastræa* (*cf.* Klunzinger, *op. cit.* vol. iii. 1879).

In pools and channels in reef-flat, Flying Fish Cove.

Genus (?) Caulastræa.

A few very varying fragments in spirit which appear to come between *Mussa* and *Caulastræa*. There is a single flabellate corallite (4·5 cm. long by 3·5 broad) which has died down, and from its fossa 3 new ones of different lengths and sizes have budded out. In addition there are two long (6 cm.) tapering corallites, with points free but fused near their rims, below which a bunch of (9) small buds project, curving upwards; below the bunch there are places where single buds have been broken off. There are two of these detached young corallites, which are very like single corallites of *Galaxea*, smooth below, ribbed above, and slightly curved. The variations among these small fragments are thus so great, that more material is necessary before any accurate account of the coral can be given, or its position in the system determined.

Genus Galaxea Oken.

Galaxea aspera Quelch.

Galaxea aspera Quelch, Chall. Rep. xvi. (1886) p. 72, pl. 4. figs. 5–5 *d*.

There is a dried specimen with a single loose corallite and a much finer specimen in good preservation in spirit. The latter shows the budding of the corallites above the level of the perithecal tissue. The specimens seem to agree in all ascertainable particulars with Mr. Quelch's species, viz., in their long projecting corallites, the septal formula, the pronounced costæ, and the dense perithecal tissue. As far as I have been able to ascertain, the locality nearest to the Keeling-Cocos group from which *Galaxea* has been recorded is the Straits of Sunda; but the specimen from that locality was referred by Milne-Edwards and Haime (see *Galaxea ellisi*, Les Cor. ii. p. 228) to the coral figured by Ellis (Phil. Trans. liii. 1764, pl. 20), which is quite different to this.

Pools in reef-flat, Flying-Fish Cove.

Genus Mussa Oken.

Mussa (?) regalis Dana.

Mussa (?) *regalis* Dana, Zoophytes, 1848, p. 182, pl. 8. fig. 5.

Two fragments of a meandrine *Mussa*. The fragments are chips from the ridges between adjoining calicles. In the smaller

dry specimen the adjoining calicles, or rather troughs, are closely adherent; the exsert septa almost overlap in the larger spirit-specimen (6 cm. long), in which the skeleton is obscured by the soft parts; the ridge between the calicles appears to widen here and there into an ambulacrum from 1–2 mm. wide. The calicular trough must have been 3 cm. deep and as much across, while the primary septa are very stout and exsert, and with their inner edges rather more vertical than in *Mussa regalis*, at least near the top of the ridge. The soft parts are bright green. Small cup-shaped galls are found on the septa here and there, somewhat like those occurring on the specimen of *Cœloria* (see below).

Occurs on the sides of the deep channels at the rim of the reef.

Genus Leptoria M.-E. & H.

Leptoria phrygia Ellis.

Leptoria phrygia Ellis, Zooph. p. 162, 1786, pl. 48.

One fragment from a massive growth. It shows both straight and gyrating calicular troughs. A good section shows the thick plate-like columella with its lobed and also finely serrated edge.

The species is said to extend over the Indo-Pacific area. Dana records it from Ceylon.

Pools on reef-flat, Flying Fish Cove.

Genus Cœloria M.-E. & H.

Cœloria sinensis M.-E. & H.

Cœloria sinensis M.-E & H. Les Cor. ii. 1857, p. 416.

One large specimen which agrees in all important points with this species. The Chinese type had calicular troughs not exceeding 2 cm. The specimen from Christmas Island has the same tendency to short troughs, some being round and only a few mm. in diameter, but a few reach to 3 and 4 cm. in length. What appear to be galls occur on the septa here and there.

Pools on reef-flat, Flying Fish Cove.

Genus Prionastræa M.-E. & H.

Prionastræa australensis M.-E. & H.

Prionastræa australensis M.-E. & H. Les Cor. ii. 1857, p. 520.

There is a narrow convex strip with the angular surface characteristic of this genus. It may provisionally be placed near *P. australensis*, with which it agrees in size of calicle, thin walls, and rudimentary columella; while round the columella a ring, often incomplete, of larger septal teeth rises up, either 2–3 on each septum, or else one large paliform tooth.

There is further a very similar specimen in spirit of the same bright green which seems common to these Christmas Island Madreporaria. It appears to have much thicker walls than the dried specimen, but the presence of the soft parts would at least partly account for this. Slightly thicker skeletal walls it may

easily have, as some variation in their thickness is observable in the dried specimens.

Pools on reef-flat, Flying Fish Cove.

Genus Agaricia Lamarck.

There is a fragment of what appears to be a flat incrusting disc with sharp free edges, the epitheca following about 1 cm. behind. The very young calicles are confluent in concentric rows but soon separate off, the smooth low rounded walls, finely striated by the septa, rapidly forming an irregular network over the surface; the calicles all look upwards, and are not tilted to look towards the growing edge. There are 4 cycles of septa—and if any columella, only in the deep calicles in the thicker parts of the stock. The section is very dense, the septa being thick and closely packed with traces of synapticular junctions.

Rock-pools under cliffs S. of Flying Fish Cove.

IV. *On the Sponges of Christmas Island.* By R. Kirkpatrick.

The Sponges collected by Mr. Andrews were obtained from an area limited to the reefs of Flying Fish Cove. The majority of the specimens were found growing on the under surface of large coral blocks lying in pools left by the tide. The use of the dredge was impossible owing to the irregular rocky nature of the bottom.

Hitherto only one species (*Pachychalina spinosissima* Dendy, P. Z. S. 1887, p. 524) has been obtained from this locality. The present collection of 53 specimens, referable to 24 genera and 32 species, contains examples of 7 new species and 2 new varieties.

The Calcarea and Monoceratina are each only represented by two small specimens.

The Carnosa are represented by three species, the occurrence of *Chondrosia plebeja* Schmidt, recorded for the first time from the Indo-Pacific, being specially interesting.

The sponge-fauna of Christmas Island, so far as known at present, is very similar to that of Java.

A list of species, arranged according to the classification of Topsent, is given below.

Sub-Class CALCAREA.

1. *Clathrina primordialis* (Haeckel).
2. *Leucandra* sp.

Sub-Class DESMOSPONGIDA.

Order Carnosa.

3. *Chondrosia reniformis* Nardo.
4. *Chondrosia plebeja* O. Schmidt.
5. *Chondrilla nuda* Lendenfeld.